

REMARKS

This Amendment is submitted in response to the Official Letter dated June 20, 2003, in which the Examiner rejected Claims 6-10. New Claims 12-21 have been added to claim additional aspects of the invention. No new matter has been added. Claims 6-10 and 12-21 are pending and remain for consideration.

The Examiner rejected Claim 10 as being indefinite under 35 U.S.C. 112. The Examiner stated that the bounds of the lateral gap and second lateral gap are indefinite. The Applicants respectfully disagree. The first gap is defined in Claim 6 as being formed between the first armature shoulder cooperating with the first pole shoulder. Claim 10 further defines the gap as being formed external to the major outer diameter of the armature. Similarly, the second gap is defined in Claim 6 by the second armature shoulder cooperating with the second pole shoulder. In Claim 10, the second gap is further defined as being internal to the major outer diameter of the armature. These gaps are also illustrated and identified in the Figures. Thus, the bounds of the first and second gaps are defined in Claim 10 (and Claim 6, from which they depend). Therefore, the Applicants respectfully request that this rejection be withdrawn.

The Examiner also rejected Claims 6-9 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent 5,110,087 to Studtmann et al. (hereinafter the '087 reference). The '087 reference teaches an electrically actuated solenoid to control a hydraulic flow valve. The '087 reference locates a working air gap surface at a position that is at a greater circumferential radius than a pole piece. The '087 reference discloses using the major diameter of the solenoid valve, minus the thickness of the coil return path casings, for the secondary (or non-force producing) magnetic gap. The primary (or useful) force-producing gap also uses the major diameter minus the thickness of the thinned armature cylindrical web. These features minimize parasitic reluctance of the secondary gap and increase rate of change of the permeance of the primary gap, both of which increase useful output force. However, this design approach makes the valve somewhat difficult to manufacture and is also difficult to seal and use under high hydraulic pressure applications. For example, high hydraulic pressures are typically be found in vehicle brake systems. The valve of the '087

reference has no provision to seal hydraulic pressures, and there is no practical means to adapt the valve to make it seal hydraulic pressures. In fact, the valve of the '087 reference is vented to the atmosphere. Thus, regardless of the actual application of the '087 valve compared to the application of the Applicants' valve, there is no disclosure or suggestion to create a pressure boundary to seal the valve of the '087 reference as is specifically claimed in Claim 6.

For at least that reason, the valve design according to the present invention is different when compared with the valve shown in the '087 reference. As amended, Claim 6 includes a closed tube structure forming a pressure boundary. This pressure boundary comprises a pressure tube that forms a pressure boundary separating the armature from the coil. Additionally, as recited in Claim 13, the control valve implements a non-magnetic material for the pressure containing structure. The resultant magnetics of this design creates a system that is completely different than that used in the '087 reference. The solenoid of the valve shown in the '087 reference has a secondary radial air gap to provide a low reluctance, non-permeance-changing flux path from the coil casing to the armature. This is for flux path coupling only and produces no axial (useful) force. The valve design according to the present invention has multiple primary, useful axial force producing gaps. The construction of these gaps allow for a high axial output force to be achieved (relatively constant force with respect to armature travel for proportional pressure control). The control valve of the present invention also specifically recites the relative locations of the gaps to each other. These particular locations are not shown or suggested in the '087 reference. The unique construction and combinations of the radial and axial magnetic gaps according to the present invention give practical and useful advantage to the control valve designs claimed. Thus, the combination of the positions of the gaps and the pressure containing structure provide distinctive operational magnetic characteristics compared to the valve of the '087 reference.

The '087 reference also specifically teaches away from the control valve design used in the present invention. Particularly, the '087 reference states that "the area of the surfaces of the radial working gap GG and return gap RR are significantly

increased by the relatively large outward radial location of the radial working gap GG and RR surfaces. The permeance of the radial working gap GG and return gap RR are greatly enhanced by these large gap areas." (Column 9, Lines 29-34). The design of the present invention does not show large gap areas at relatively large outward radial locations. In fact, the opposite is shown and described in the application.

In view of the foregoing amendment, remarks and arguments, it is believed that Claim 6 is in condition for allowance. Since Claims 7-10, and 12-15 depend from Claim 6, it is believed that those claims are also allowable. New Claims 16-21 also claim features that are patentably distinct from the '087 reference. Therefore, Applicants contend that all of the pending claims are patentable over the Examiner's rejections, and requests reconsideration and withdrawal of the rejection of Claims 6-10.

For all the above reasons, Applicants believe that the Application is now in condition for Allowance. However, if the Examiner feels that he is unable to issue a Notice of Allowance for any reason, Applicants request that the Examiner contact Applicants' attorney, Shital A. Shah, at 419.255.5900 to discuss this case.